

103. (Amended) The laser scanning system of claim 102, wherein the depth of said first portion is less than 3.5 inches.

104. (Amended) The laser scanning system of claim 102, wherein a second set of said plurality of laser scanning stations produce a second plurality of laser scanning planes passing through said side window.

105. (Amended) The laser scanning system of claim 104, wherein said second portion houses groups of light bending mirrors [for] associated with said second set of light scanning stations.

106. (Amended) The laser scanning system of claim 102, wherein the volume of said housing is less than 2000 cubic inches.

107. (Amended) The laser scanning system of claim 102, wherein the volume of said housing is less than 1650 cubic inches.

109. (Amended) The laser scanning system of claim 102, wherein resolution of a bar code symbol that [the] said laser scanning planes can resolve is on the order of 0.006 inches wide.

112. (Amended) The laser scanning system of claim 111, wherein said plurality of multi-faceted volume holographic elements are supported by a scanning disc.

113. (Amended) The laser scanning system of claim 102, wherein some of said groups of light bending mirrors cooperate with light [directly] directing elements that have high elevation angle characteristics, and other groups of light bending mirrors cooperate with light [directly] directing elements that [having] have low elevation angle characteristics.

114. (Amended) The laser scanning system of claim 102, wherein some of said groups of light bending mirrors cooperate with light directing elements that have left skew angle characteristics,

and other groups of light bending mirrors cooperate with light directing elements that have right skew angle characteristics.

117. (Amended) The laser scanning system of claim 102, wherein some of said light bending mirrors having a different number of vertices than do other light bending mirrors.

119. (Amended) The laser scanning system of claim 102, wherein each said laser scanning station includes light collection optical elements comprising a parabolic mirror and a photodetector.

121. (Amended) The laser scanning system of claim [102] 104, wherein said bottom window has a substantially horizontal orientation and said side window has a substantially vertical orientation, and wherein said second set of laser scanning stations comprise a single laser scanning station that produces laser scanning planes passing through said side window.

122. (Amended) The laser scanning system of claim 102, wherein said bottom and side windows include a spectral filtering subsystem that transmits a narrow band of spectral components of light including the light associated with said laser scanning planes.

125. (Amended) The laser scanning system of claim 102, [further comprising] which further comprises light collection optical elements coupled to signal processing circuitry that has multiple decoding channels.

126. (Amended) The laser scanning system of claim 125, [further comprising] which further comprises a mechanism for linking, in each decoding channel, a particular optical path to a given scan data signal.

127. (Amended) The laser scanning system of claim [126, further comprising] 125, which further comprises a mechanism for analyzing scan data signal fragments over multiple decoding channels to identify bar code symbols therein.

129. (Amended) The laser scanning system of claim [63] 102, wherein a given laser scanning station produces scan lines that pass through said second window, said given laser scanning station comprising a collimating lens that cooperates with said plurality of holographic optical elements to increase focal distance of scan lines passing through said second window, thereby allowing said plurality of holographic optical elements to be used in producing scan lines that pass through both first and second windows.

130. (Amended) The laser scanning system of claim [71] 129, wherein said holographic optical elements are integrated in a rotating disc, and wherein said photodetector is mounted directly above the edge of the rotating disc.

131. (Amended) The laser scanning system of claim [71] 129, wherein said holographic optical elements are integrated in a rotating disc, and wherein said photodetector is mounted outside the outer periphery of the rotating disc.

132. (Amended) The laser scanning system of claim [59] 129, wherein at least one member of said first group G_1 of holographic optical elements have symmetrical left skew angle characteristics with respect to the right skew angle characteristics of at least one corresponding member of said second group G_2 of holographic optical elements.

133. (Amended) The laser scanning system of claim [59] 129, [comprising] which comprises multiple holographic optical elements [which] that simultaneously focus multiple scanning beams to overlapping regions in a 3-D scanning volume at varying focal distances (preferably, [less than] 2 inches or less difference in focal distance), which minimizes the effects of paper noise.

REQUIREMENT UNDER 37 C.F.R. 1.121

As required under 37 C.F.R. 1.121, and pursuant to the present Amendment, a clean set of Claims is set forth below.

1 ~~102~~. A laser scanning system comprising:

a housing having a first portion and a second portion, said first portion having a bottom window, and said second portion having a side window; and

a plurality of laser scanning stations disposed within said housing,

wherein each said laser scanning station comprises a light beam source and corresponding groups of light bending mirrors disposed within said housing, that cooperate with a plurality of light directing elements to produce laser scanning planes that are projected within a 3-D scanning volume disposed above said bottom window and adjacent said side window;

wherein a first set of said plurality of laser scanning stations, are disposed within said first portion of said housing, and produce a first set of laser scanning planes passing through said bottom window;

wherein said first portion of said housing has a depth of less than 5 inches.

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~~103~~. The laser scanning system of claim ~~102~~, wherein the depth of said first portion is less than 3.5 inches.

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~~104~~. The laser scanning system of claim ~~102~~, wherein a second set of said plurality of laser scanning stations produce a second plurality of laser scanning planes passing through said side window.

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~~105~~. The laser scanning system of claim ~~104~~, wherein said second portion houses groups of light bending mirrors associated with said second set of light scanning stations.

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~~106~~. The laser scanning system of claim ~~102~~, wherein the volume of said housing is less than 2000 cubic inches.

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107. The laser scanning system of claim ~~102~~¹, wherein the volume of said housing is less than 1650 cubic inches.

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108. The laser scanning system of claim ~~102~~¹, wherein said 3-D scanning volume is greater than 400 cubic inches.

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109. The laser scanning system of claim ~~102~~¹, wherein resolution of a bar code symbol that said laser scanning planes can resolve is on the order of 0.006 inches wide.

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110. The laser scanning system of claim ~~102~~¹, wherein said laser scanning planes are quasi-orthogonal.

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111. The laser scanning system of claim ~~102~~¹, wherein said plurality of light directing elements comprise a plurality of multi-faceted volume holographic elements.

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112. The laser scanning system of claim ~~111~~¹⁰, wherein said plurality of multi-faceted volume holographic elements are supported by a scanning disc.

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113. The laser scanning system of claim ~~102~~¹, wherein some of said groups of light bending mirrors cooperate with light directing elements that have high elevation angle characteristics, and other groups of light bending mirrors cooperate with light directing elements that have low elevation angle characteristics.

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114. The laser scanning system of claim ~~102~~¹, wherein some of said groups of light bending mirrors cooperate with light directing elements that have left skew angle characteristics, and other groups of light bending mirrors cooperate with light directing elements that have right skew angle characteristics.

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115. The laser scanning system of claim ~~102~~¹, wherein said bottom window has a substantially horizontal orientation and said side window has a substantially vertical orientation.

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~~116.~~ The laser scanning system of claim ~~102~~¹, wherein said plurality of laser scanning stations comprise four laser scanning stations.

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~~117.~~ The laser scanning system of claim ~~102~~¹, wherein some of said light bending mirrors having a different number of vertices than do other light bending mirrors.

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~~118.~~ The laser scanning system of claim ~~102~~¹, wherein geometry, placement and orientation of said light bending mirrors are optimized to satisfy physical constraints with respect to said housing.

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~~119.~~ The laser scanning system of claim ~~102~~¹, wherein each said laser scanning station includes light collection optical elements comprising a parabolic mirror and a photodetector.

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~~120.~~ The laser scanning system of claim ~~119~~¹⁸, wherein said photodetector is substantially disposed above incidence of light beams onto said light directing elements.

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~~121.~~ The laser scanning system of claim ~~104~~³, wherein said bottom window has a substantially horizontal orientation and said side window has a substantially vertical orientation, and wherein said second set of laser scanning stations comprise a single laser scanning station that produces laser scanning planes passing through said side window.

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~~122.~~ The laser scanning system of claim ~~102~~¹, wherein said bottom and side windows include a spectral filtering subsystem that transmits a narrow band of spectral components of light including the light associated with said laser scanning planes.

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~~123.~~ The laser scanning system of claim ~~102~~¹, wherein said light beam source for a given laser scanning station includes a visible laser diode, at least one collimating lens and a diffractive optical element producing S polarized light.

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~~124.~~ The laser scanning system of claim ~~123~~, wherein said collimating lens and diffractive optical element substantially eliminate astigmatic characteristics of light produced by the visible laser diode.

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~~125.~~ The laser scanning system of claim ~~102~~, which further comprises light collection optical elements coupled to signal processing circuitry that has multiple decoding channels.

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~~126.~~ The laser scanning system of claim ~~125~~, which further comprises a mechanism for linking, in each decoding channel, a particular optical path to a given scan data signal.

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~~127.~~ The laser scanning system of claim ~~125~~, which further comprises a mechanism for analyzing scan data signal fragments over multiple decoding channels to identify bar code symbols therein.

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~~128.~~ The laser scanning system of claim ~~102~~, wherein said first portion of the housing is disposed under a counter in a point of sale application.

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~~129.~~ The laser scanning system of claim ~~102~~, wherein a given laser scanning station produces scan lines that pass through said second window, said given laser scanning station comprising a collimating lens that cooperates with said plurality of holographic optical elements to increase focal distance of scan lines passing through said second window, thereby allowing said plurality of holographic optical elements to be used in producing scan lines that pass through both first and second windows.

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~~130.~~ The laser scanning system of claim ~~129~~, wherein said holographic optical elements are integrated in a rotating disc, and wherein said photodetector is mounted directly above the edge of the rotating disc.

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~~131.~~ The laser scanning system of claim ~~129~~, wherein said holographic optical elements are integrated in a rotating disc, and wherein said photodetector is mounted outside the outer periphery of the rotating disc.

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132. The laser scanning system of claim ~~129~~, wherein at least one member of said first group G_1 of holographic optical elements have symmetrical left skew angle characteristics with respect to the right skew angle characteristics of at least one corresponding member of said second group G_2 of holographic optical elements.

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133. The laser scanning system of claim ~~129~~, which comprises multiple holographic optical elements that simultaneously focus multiple scanning beams to overlapping regions in a 3-D scanning volume at varying focal distances (preferably, 2 inches or less difference in focal distance), which minimizes the effects of paper noise.